

Studies on spiroboloid millipeds

IV. Systematic and nomenclatorial notes on the family *Pachybolidae*¹

by

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With 20 text-figures.

Writing in 1936, the late Count von ATTEMS remarked that "The Indian Spiroboloidea are as yet as incompletely known as the remaining Diplopod groups, and the list of species in this order will increase considerably on intensive exploration." Subsequently a number of new species and genera have been described from India and neighboring countries by ATTEMS (1937, 1953), CARL (1941), and by VERHOEFF (1936, 1938). Unfortunately, there already existed a large backlog of poorly described or otherwise enigmatic spiroboloid species in southeast Asia. Dr. CARL disposed of some of these forms in several contributions, but his endeavors were more than misbalanced by the names introduced by VERHOEFF in a very irresponsible way.

Upon having the opportunity during 1960 to spend some time studying milliped types in the major European museums, I was able to examine typical material of numerous spiroboloid species particularly in the family *Pachybolidae*. The accumulated notes and drawings, while by no means adequate to form the basis for any large revisionary work, are certainly of interest in clarifying the status and relationships of many genera as well as species, and

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are here published with the anticipation that they will prove useful to other students of the Diplopoda.

I have to extend my thanks to Dr. G. Owen Evans (British Museum, London), Dr. Wolfgang Engelhardt (Zoologische Staatssammlung, München), Dr. G. Pretzmann (Naturhistorisches Museum, Wien), and to Dr. H. Gisin (Muséum d'Histoire naturelle de Genève) for the privilege of studying the collections under their care. Most of the following paper is based upon specimens in the important and well-ordered collection built up at Geneva by Drs. de Saussure and J. Carl.

Order **SPIROBOLIDA**

Family **PACHYBOLIDAE**

Pachybolidae Cook, 1897, Brandtia, p. 74. — Brolemann, 1913, Bull. soc. ent. France, No. 19, p. 477. — Attems, 1926, Handbuch der Zoologie, vol. 4, p. 196.

Spiromimidae Brolemann, 1913, Bull. soc. ent. France, No. 19, p. 477. — Verhoeff, 1936, Rec. Indian Mus., vol. 38, p. 305.

Trigoniulidae Attems, 1909, in Sjöstedt: Ergeb. Schwed. Exp. Kilimandjaro, vol. 3. No. 19, p. 25. — Brolemann, 1913, Bull. soc. ent. France, No. 19, p. 477. — Attems, 1926, Handbuch der Zoologie, vol. 4, p. 196.

Atopochetidae Attems, 1953, Mem. mus. Nat. hist. natur., ser. A, vol. 5, p. 191. **NEW SYNONYMY!**

The status of the various family groups recognized in the so-called trigoniuloid branch of the *Spirobolida* is, in my opinion, very unsatisfactory. Characters upon which several of the families were based reside in minor features of the gonopods, and it is likely that the family *Trigoniulidae* will be found to grade inseparably into a large group for which the oldest name is Cook's *Pachybolidae*.

ATTEMs (1926), condensing the original diagnoses worked out by Brolemann, summarizes the essential differences between the groups *Trigoniulidae*, *Pachybolidae*, and *Spiromimidae*:

Trigoniulidae: "The coxite of the posterior gonopod consists of two strong pieces forming a right angle and connected by membrane. The tracheal apodemes are attached by a loose

joint. The telopodite is readily separated from the coxite. A distinct articulation of the telopodite is seldom evident. The inner process is to be recognized as tibial process, the part distad of it as the tarsus.

"The two glands in the posterior gonopods, and the finger-shaped apophyses are generally present.

"Coxite and telopodite of the anterior gonopods short and broadly laminate, rarely one of the elements extended longer and more slender."

Pachybolidae: "Coxite of the posterior gonopods completely chitinized and fused with the telopodite forming a right angle. In the base of the posterior gonopod always only one gland, and no fingershaped apophyses.

"Anterior gonopods as in the *Trigoniulidae*, more broad and short."

Spiromimidae: "Coxite of the posterior gonopod completely chitinized, fused with the telopodite. The entire gonopod forms a broad "C", constricted at the midlength.

"In the base only one gland at the origin of the seminal groove, no fingershaped apophyses.

"All parts of the anterior gonopods extended long and slender."

I think it must be admitted that such characters are not only of a somewhat minor importance, but liable to some degree of variation and intermediacy. The more recently proposed family *Atopochetidae* was based primarily on one single character stated by Attems: "Prostatakanal endet im Innenarm, neben seinem Ende beginnt ein Sperma Kanal, der im Tibiotarsus endet." I believe that this condition is the result of a faulty observation, as discussed below. The nominal genus *Atopochetus* (clearly based on a pachybolid) is perhaps a synonym of *Aulacobolus*; whereas the other genus originally included in the *Atopochetidae* — *Prionopezia* Attems — is a typical trigoniulid, apparently the same as *Zygostrophus* Chamberlin!

In general, I believe that there is very little basis for continued recognition of the "families" *Spiromimidae* and *Atopochetidae*. The only remaining problem is whether the *Trigoniulidae* is a valid family or only a subfamily or tribe of the *Pachybolidae*. This is

something which can be settled only by future study of a dozen or so poorly known Asiatic genera. The two groups as presently defined are to some extent geographically exclusive, the "*Pachybolidae*" occurring chiefly in tropical Africa and India, the "*Trigoniulidae*" largely in the Indo-australian region.

I. African forms

Genus *Pelmatojulus* Saussure

Pelmatojulus Saussure, 1860, Mem. Soc. Phys. Hist. Natur. Genève, vol. 15, pt. 2, p. 531 (=331). Type species: *P. insignis* Saussure, by present designation.

Pachybolus (in part) Cook, 1897, Brandtia, p. 74.

This name has been overlooked or disregarded virtually since the date of its proposal. Originally proposed as a subgenus of *Julus*, it was erected to include all juliform diplopods in which one or more of the podomeres have ventral pads or cushions ("Tarses garnis en dessous d'une pelote ou semelle."). The name was nominally mentioned by PORAT (1872) and KARSCH (1881); subsequently it slipped into obscurity, even to being overlooked by HOFFMAN and KEETON (1960) during compilation of their list of spiroboloid genera.

Actually, *Pelmatojulus* has every right to consideration as a valid and occupied name. Originally it was highly composite, including members of what we now regard as two different orders, consisting of three subdivisions:

(1) Legs with the three distal podomeres padded ventrally. The example cited was *Julus vittatus* Newport, 1844 (= *Anurostreptus vittatus*, *Harpagophoridae*).

(2) Legs with the last two podomeres padded ventrally. The example cited was *Julus malabaricus* Gervais, 1847.

(3) Legs with only the 6th or 7th article padded. The only species mentioned by name to typify this division was *Julus insignis*, described as a new species.

In the absence of any previous attempt at precise typification, I herewith select *insignis* as the type species of *Pelmatojulus*. The

species was described and illustrated in considerable detail, only the genitalia were disregarded. The type specimen was said to have come from "La République Argentine".

The status of such a large and striking spiroboloid has long been a matter of much curiosity to me, so it was with much pleasure that I was finally able to extract the genitalia from the dry, pinned holotype at Geneva. These structures have been extensively damaged by dermestid beetles, but enough remains to show without any doubt that *insignis* is the same species as that named later by O. F. Cook as *Pachybolus laminatus* from Liberia!

This discovery does not in itself mean that Cook's generic name must fall as a synonym of *Pelmatojulus*, because in my opinion future studies will show that the West African species referred by Cook to *Pachybolus* are not congeneric with *P. tectus* from Zanzibar. Until such studies are made, I refrain from attempting to distinguish the genera on the basis solely of published works. In passing, however, I can observe that in most cases, the diplopod faunas of West Africa and the Congo Basin are trenchantly distinct from the isolated vicariant forms occurring along the East Africa coastal strip. Probably the generic distinctions in the pachybolids will be drawn along the same line.

Pelmatojulus insignis Saussure

Iulus (Pelmatojulus) insignis Saussure, 1860, Mem. Soc. Sci. Phy. Nat. Genève, vol. 15, pt. 2, p. 531 (=331), pl. IV, figs. 26 *a-n*.

? *Spirobolus giganteus* Porat, 1872, Ofv. K. Vet.-Akad. Förhandl., No. 5, p. 17.

Pachybolus laminatus Cook, 1897, Brandtia, p. 74; 1899, Proc. U.S. Nat. Mus., vol. 21, p. 659, pl. L, figs. 3 *a-f*.

Type specimens: Of *insignis*, Mus. hist. nat. Genève; of *giganteus*, Naturh. Riksmus. Stockholm; of *laminatus*, U.S. Nat. Mus. Washington.

Remarks: There is no doubt whatever that *giganteus* is congeneric with *insignis*, a possibility noted even by Porat who had only external features to judge from ("Arten har stor frändskap till *Sp. crassicollis* Peters... och *Iulus insignis* Sauss.").

The locality label with the type of *insignis* reads "La Plata, M. Melly". Saussure transcribed this as "La République Argen-

tine", but obviously the data are incorrect. The two male types of *giganteus* are from Sierra Leone, the holotype of *laminatus* from Liberia. I believe, contrary to the opinion of Cook, that these two names represent the same species. This can easily be verified by a future study.

Whether all three names cited above are junior synonyms of Newport's earlier (1844) *Spirobolus pulvillatus* also remains to be settled.

Pelmatojulus excisus (Cook), new combination.

Pachybolus excisus Cook, 1897, Brandtia, p. 74; 1899, Proc. U.S. Nat. Mus., vol. 21, p. 660, pl. LI, figs. 1 a-f.

Spirobolus simulans Carl, 1905, Mem. Soc. Espan. Hist. Nat., vol. 1, p. 277, figs. 8, 8 a. NEW SYNONYMY!

Type specimens: of *excisus*, Berlin Museum, No. 1324; of *simulans*, Mus. Hist. nat. Genève.

Remarks: There is no doubt that the two names cited are based upon the same species. Cook's types were from Kamerun, in part from Kribi in that colony, while Carl's type came from Cabo San Juan, Spanish Guinea, which is less than 150 km south of Kribi. It is curious that the characteristically painstaking Carl overlooked Cook's two papers on the West African *Pachybolidae*.

Pachybolus dimorphus (Carl), new combination.

Trigoniulus dimorphus Carl, 1909, Rev. Suisse Zool., vol. 17, No. 2, p. 362, pl. 7, figs. 31-34.

Type specimen: Male, Mus. Hist. nat. Genève, from Dar-es-salaam, Tanganyika.

Remarks: Carl remarked the relationship of this species with those named by Cook in *Pachybolus*, but did not explain his preference for the name *Trigoniulus*. So far as I know, *dimorphus* has not been subsequently mentioned in the literature. It appears to be easily recognizable from *P. tectus*, approaching more closely to *P. morogoroensis* Kraus particularly in characters of the phallopods.

Genus **Metiche** Attems

Epibolus Cook, 1897, Brandtia, p. 75 (preoccupied by *Epibolus* Fleming, 1822). Type species: *Spirobolus pulchripes* Gerstäcker, 1873, by original designation.

Metiche Attems, 1909, in Sjöstedt: Ergeb. Schwed. Exped. Kilimandjaro, vol. 3, No. 19, p. 25. Type species: *Trigoniulus bravensis* Silvestri, 1897, by monotypy.

Callipodolus Hoffman and Keeton, 1960, Trans. American Ent. Soc., vol. 86, p. 11 (new name for *Epibolus* Cook). Type species: *Spirobolus pulchripes* Gerstäcker, 1873, by original designation. NEW SYNONYMY!

This East African pachybolid genus is easily recognized by the presence, on the phallopod, of a distinct and moveable process (considered by Attems to be the tarsus). Until recently, *Metiche* was considered monotypic; in 1958 Dr. KRAUS renamed as *M. attemsi* the specimens recorded by ATTEMS (1909) from Kenya as *bravensis*.

Epibolus was based on *Spirobolus pulchripes*, the types of which had been studied by Cook in the Berlin Museum. Unfortunately, the male genitalia of this species were illustrated by neither Gerstäcker nor Cook, although they were briefly described in the original diagnosis of *Epibolus*:

"Sternum of copulatory legs produced in the middle to equal the anterior lamellae; flagella concealed; posterior lamellae not incised; *flagella on the lateral margin with a long obclavate appendage articulated at base* [italics mine]; legs of males with three pairs of bristles on the ventral face of the last joint; fleshy sole not produced beyond the last pair of bristles; fifth joint subequal to the fourth: Genus *Epibolus*, type *E. pulchripes* (Gerstäcker), Zanzibar."

If we understand Cook to have meant *coxae* by "anterior lamellae", *phallopod* by "flagella", and *telopodites* by "posterior lamellae", the preceeding diagnosis gives a very clear picture of the gonopods of *Metiche*. Obviously, Attems (as well as his successors) never took the trouble to read Cook's diagnoses carefully!

It is even more remarkable to note that, for an unknown period of time, Count Attems had in his possession a typical specimen of *pulchripes* which he had never dissected for gonopod study! In the collection of the Naturhistorisches Museum, Wien, is a male in very good condition: I removed the gonopods and discovered that

pulchripes is congeneric with *M. bravensis*. The label present with the specimen is as follows:

618.

Spirobolus pulchripes Gerst.

Zanzibar, v. d. Decken

Unquestionably this diplopod is from the original series of co-types. Since the myriapod collection of the Berlin Museum is known to have suffered considerable damage and disorganization during the recent war years, the present status of the other specimens is unknown. Owing to this uncertainty, as well as to the difficulties imposed by current political conditions, I think it is advisable to designate the Wien specimen as *lectotype* of *Spirobolus pulchripes*.

The number of species in *Metiche* is now brought up to four, all of which are confined to the coastal region of East Africa from Tanganyika to Somalia, a range of nearly 1000 km. Judged from existing illustrations, all four are closely related; I think that *M. tanganyicense* Kraus may prove to be a junior synonym of *pulchripes*.

Metiche pulchripes (Gerstäcker), new combination.

Figs. 1, 2.

Spirobolus pulchripes Gerstäcker, 1873, in Van der Decken, Reisen in Ostafrika. vol. 3, No. 2, p. 515.

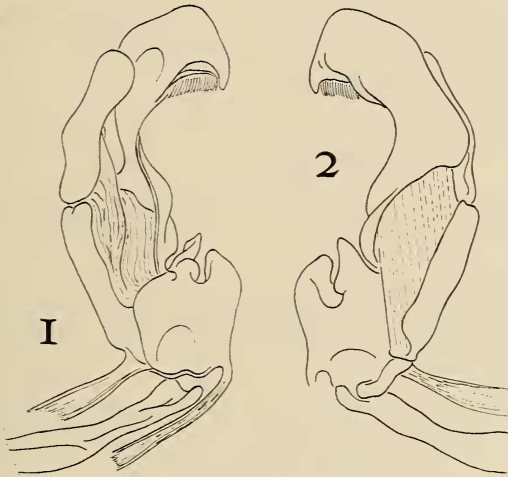
Epibolus pulchripes Cook, 1897, Brandtia, p. 97.

Callipodolus pulchripes Hoffman and Keeton, 1960, Trans. American Ent. Soc., vol. 86, p. 11.

Type specimen: Male lectotype, Naturh. Mus. Wien, from Zanzibar, Tanganyika.

Remarks: In mesial aspect, the phallopod contains a considerable amount of white sclerotized connective tissue between coxa, femur, and postfemur (shown by wavy lines in fig. 1). On the lateral side of the phallopod, there is a large and distinct mass of muscle tissue extending from the femur to postfemur, this is indi-

cated by broken lines in fig. 2, but this muscle is actually covered by a thin, transparent layer of chitin. As in the other two species, there is a conspicuous seminal groove from the coxal gland, it terminates distally between two thin, closely appressed pectinate lamellae. In this character, *Metiche* shows some relationship with *Trachelomegalus* of Borneo, but the two genera differ in nearly all other respects.



Metiche pulchripes (Gerstäcker).

FIG. 1. Phallopod from the lectotype, mesial side.

FIG. 2. The same, from the lateral side.

Metiche bravensis (Silvestri)

Trigoniulus bravensis Silvestri, 1897, Ann. mus. civ. stor. nat. Genova, vol. 37, p. 307.

Metiche bravensis Attems, 1909, in Ergeb. Schwed. Exped. Kilimandjaro, vol. 3, No. 19, p. 26 (combination only, misidentification of species).

Metiche bravensis Kraus, 1958, Veroff. Ueberseemus. Bremen, ser. A, vol. 3, p. 6.

Type specimens: Cotypes, Mus. stor. nat. Genova, from Brava, Italian Somaliland.

Remarks: KRAUS (op. cit.) has expressed the opinion that the specimens reported by ATTEMs in 1909 as *bravensis* are not con-

specific with Silvestri's types, making the distinction primarily on the shape of the anterior gonopods. For the misidentified Attemasian specimens, Kraus proposed the name:

Metiche attemsi Kraus

Metiche bravensis (non Silvestri) Attems, 1909, *Ergeb. Schwed. Exped. Kilimandjaro*, vol. 3, No. 19, p. 26, figs. 25, 107, 108.

Type specimens: Cotypical series, Naturh. Riksmus. Stockholm; from Tanga and Mombo, Usambara Dist., Tanganyika, no lectotype has been designated.

Metiche tanganyicense Kraus

Metiche tanganyicense Kraus, 1958, *Veroff. Ueberseemus. Bremen*, vol. 3, p. 7, figs. 12-16.

Type specimens: Male holotype, Ueberseemus. Bremen, TK 329/1, male paratype, Senckenberg Mus. 2797, from Msala, Rufiji Delta, Tanganyika.

Remarks: This form appears to be identical with *M. pulchripes*, as a comparison of the illustration published by Kraus with those given here (figs. 1, 2) will indicate.

II. Asiatic forms

Genus **Trachelomegalus** Silvestris

Trachelomegalus Silvestri, 1896, *Ann. mus. civ. stor. nat. Genova*, vol. 34, p. 27. Type species: *Spirobolus hoplurus* Pocock, 1893, by original designation.

In the years following Silvestri's proposal of this generic name, a considerable number of species have been either described in, or referred to, *Trachelomegalus*. The various species so allocated have never, however, been carefully compared, and since *T. hoplurus* is endemic to Borneo, while its ostensible congeners occur in the "Lower India" region, it has long seemed likely to me that two different genera might be confused under the one name.

At the Museum d'Histoire naturelle de Genève, I was able to directly compare specimens of *T. hoplurus* from Borneo with material of *T. sumatranus* from the island of Sumatra. On the basis of this comparison, supplemented by the examination of related species at London, München, and Wien, I could confirm my original surmise, and distinguish two genera by the following characters:

Trachelomegalus (hoplurus)

Collum very long, extending ventrad below level of labrum, the lower ends turned caudad.

Segments 2 and 3 dissimilar: 2 extends further ventrad than 3 and 4.

Metazonites of greater diameter than prozonites, imparting a distinctly annulate body outline.

Tarsal pads short: $\frac{1}{2}$ to $\frac{2}{3}$ rds length of ventral surface of the tarsal segment.

Legs very long, their length greater than diameter of the body.

Sympleurites of segment 7 form a transverse, thin, median crest.

Sternal apodemes of coleopods with distinct, slender, retrorse processes (fig. 3, AcP).

Telopodites of coleopods small, slender, apically drawn out into a slender process (fig. 4).

The group of *sumatranus*,
lacinosus, *moulmeinensis*, et alia

Collum not so large, not extending ventral to level of labral edge, the lower ends not turned caudad.

Segments 2 through 4 all attaining the same level ventrally.

Both subsegments of essentially the same diameter: body thus parallel-sided.

Tarsal pads extend the entire length of the tarsal segment on the ventral side.

Legs shorter, less than diameter of body.

Sympleurites merely elevated somewhat, not forming a thin crest.

Sternal apodemes of coleopods normal in form, without accessory processes.

Telopodites of coleopods broad, short, and flattened, of the form shown in fig. 11.

So far as I know, *Trachelomegalus* in this restricted sense is confined to Borneo. The species which I here remove from it appear to be congeneric among themselves, and likewise occupy a reasonably continuous and zoogeographically logical range. The name *Tonkinbolus* has been proposed by Verhoeff for one of these species, and it is provisionally adopted as the correct generic name.

Trachelomegalus hoplurus (Pocock)

Figs. 3-7.

Spiroboldus hoplurus Pocock, 1893, Ann & Mag. Nat. Hist., ser. 7, vol. 11, p. 252, pl. 16, fig. 5.

Trachelomegalus hoplurus Silvestri, 1896, Ann. Mus. civ. stor. nat. Genova, vol. 36, p. 27.

? *Trachelomegalus hoplurus* Attems, 1897, Abhandl. Senckenb. naturforsch. Gesell., vol. 23, p. 517, figs. 36-38.

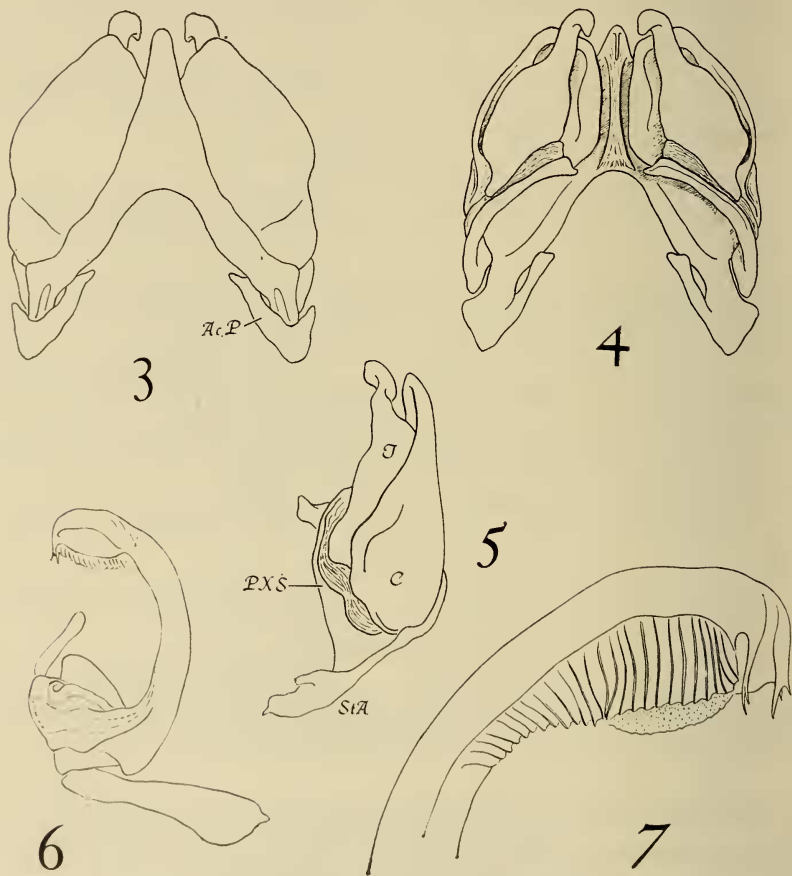
*Trachelomegalus hoplurus* (Pocock).

FIG. 3. Coleopod, anterior aspect. — FIG. 4. Coleopod, posterior aspect. — FIG. 5. Coleopod, lateral aspect. — FIG. 6. Phallopod, lateral aspect. — FIG. 7. Phallopod, distal end, enlarged, showing form of terminal processes and spermatophore (stippled). AcP: accessory process of sternal apodeme; StA: sternal apodeme; PXS: posterior extension of sternite.

Type specimens: Cotype series, Brit. Mus. (Nat. Hist.).

Remarks: The specimen here reported and illustrated is in the collection at Geneva; it was collected at Sarawak, Borneo, by MM. Bedot and Pictet.

From the standpoint of gonopod structure, this species show some interesting peculiarities. The telopodite of the phallopods is relatively small and is distally attenuated. The sternal apodeme is provided with a distinct subterminal process which is directed distomedially, paralleling the lateral extension of the sternite (fig. 3, AcP).

In *Trachelomegalus*, as well as related pachybolid genera, the posterior extensions of the coleopod sternite ("brides tracheennes" of Brolemann) are not attached to either the coxite or telopodite except by connective tissue, in fact, the coxites are not extended caudomesiad between the sternal extensions and the telopodites as they are in many other spiroboloid genera (fig. 5, PXS).

It is not certain that the specimens recorded as *hoplurus* by ATTEMS (1897) from the Baram River in Borneo are in fact conspecific with Pocock's types. I am likewise unable to express an opinion on the several species described by Silvestri in 1896. Clearly, however, *Trachelomegalus* appears to be endemic to Borneo.

Genus **Tonkinbolus** Verhoeff

Trachelomegalus (sensu auctt., non Silvestri).

Tonkinbolus Verhoeff, 1938, Zool. Jahrb. Abt. Syst., vol. 71, p. 35. Type species: *T. scaber* Verhoeff, by monotypy.

This genus has been distinguished from *Trachelomegalus* in a preceeding paragraph. It includes at least five species, probably others will be added from the ranks of currently unrecognizable names based on Asiatic spiroboloids. *T. scaber* is slightly different from the others in that the coleopod telopodite is distally simple and acuminate, not uncinatate as in most pachybolids. I do not think that this difference is more than specific in importance, however.

The range of *Tonkinbolus* is fairly small and coherent: the Indo-chinese peninsula, Malaya, and Sumatra. I refer to it the following species:

Tonkinbolus scaber Verhoeff

Figs. 8-9.

Tonkinbolus scaber Verhoeff, 1938, Zool. Jahrb., Abt. Syst., vol. 71, p. 35.

Type specimens: Zool. Staatssamm. München. In 1960 I was able to discover only two microscope preparations of gonopods, both marked with a red "X" in the manner used by Verhoeff to designate type material.

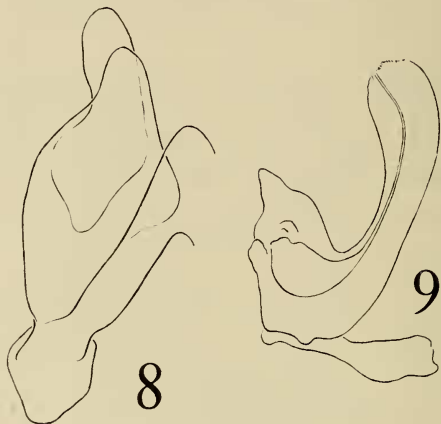
*Tonkinbolus scaber* Verhoeff.

FIG. 8. Left half of coleopods, anterior aspect, drawn from type slide. —
FIG. 9. Phallopod, lateral aspect. Both drawings made from a macerated,
and therefore distorted, slide preparation.

Remarks: The original illustrations, curiously enough, do not show the gonopods in their entirety, only certain regions. I here-with provide sketches for comparison with the published drawings of the other species.

The type specimens originated in Tonkin (North Viet-Nam) without precise data.

Tonkinbolus caudulanus (Karsch), new combination.

Spirobolus caudulanus Karsch, 1881, Zeitschr. Naturwissen., ser. 3, vol. 6, p. 60. — Pocock, 1893, Ann. mus. civ. stor. nat. Genova, vol. 33, p. 394. — Attems, 1936, Mem. Indian Mus., vol. 11, p. 313.

Type specimens: Female holotype, Berlin Museum, from "Siam", Dr. Schetely, leg.

Remarks: Pocock recorded the species from numerous localities in extreme southern Burma, giving a good account of colour variation. Although he had male specimens, he gave only a verbal account of them, and the species has therefore remained in doubt down to the present.

There is still an element of doubt that Pocock's identification is correct. Karsch's type was a female, without precise locality although probably from the vicinity of Bangkok. The examination of males from that locality will of course provide final stability to *caudulanus*, and enable a revision of the other species, something which is very desirable.

Tonkinbolus moulmeinensis (Pocock), new combination.

Figs. 10-12.

Spirobolus moulmeinensis Pocock, 1893, Ann. mus. civ. stor. nat. Genova, vol. 33, p. 395.

Type specimens: Brit. Mus. (Nat. Hist.), from Moulmein, Burma. Both males and females are in the type series, I have designated the male dissected by Pocock as the lectotype.

Remarks: Pocock's description of the species compares it with *caudulanus*, from which it is said to differ in colour and in the shape of the coleopod telopodite. It seems probable that most of the forms here referred to *Tonkinbolus*, particularly *moulmeinensis*, *macrurus*, *dollfusi*, and *caudulanus*, will be eventually proven only geographic races of one variable species.

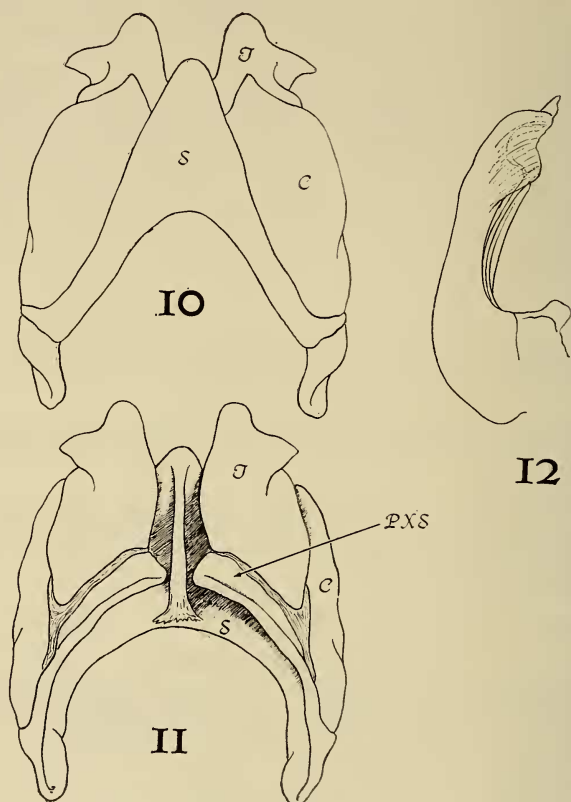
In the phallopod of this species, the basal gland is not well-defined. The seminal groove terminates in a flattened calyx formed by thin, hyaline chitin at the tip of the appendage. This area, while superficially similar, is different from the pendant, pectinate, and much more delicate subterminal fringes of *Trachelomegalus*.

Tonkinbolus macrurus (Pocock), new combination.

Spirobolus macrurus Pocock, 1893, Ann. Mus. civ. stor. nat. Genova, vol. 33, p. 396.

Type specimen: Female, Brit. Mus. (Nat. Hist.), from Kaw-kareet, Tenasserim, lower Burma.

Remarks: Said to be closely related to *moulmeinensis*, differing only in the longer and more slender epiproct.



Tonkinbolus moulmeinensis (Pocock).

FIG. 10. Coleopods, anterior aspect. — FIG. 11. Coleopods, posterior aspect. — FIG. 12. Phallopod, lateral aspect. Drawings from the male lectotype. PXS: posterior extension of the sternite.

Tonkinbolus dollfusii (Pocock), new combination.

Spirobolus dollfusi Pocock, 1893, Ann. mus. civ. stor. nat. Genova, vol. 33, p. 397.

Type specimen: Male, Brit. Mus. (Nat. Hist.), from "Cochin China".

Remarks: Said to differ from *caudulanus* in small details of colour pattern and shape of the parts of the coleopods. Insofar as

the very brief comparison indicated, *dollfusi* seems to bear a considerable resemblance to the species described by ATTEMS (1937) as *Aulacobolus rubropunctatus* from Ream, Cambodia. A restudy of the type of *dollfusi* should readily establish its correct status.

Tonkinbolus sumatranus (Carl), new combination.

Trachelomegalus sumatranus Carl, 1906, Zool. Jahrb. Abt. Syst., vol. 24, p. 243, pl. 17, figs. 15-18.

Type specimen: Male, Mus. Hist. nat. Genève, from "Sumatra".

Remarks: Very similar to the following species.

Tonkinbolus laciniatus (Attems), new combination.

Trachelomegalus laciniatus Attems, 1937, Stettiner Ent. Zeitschr., vol. 2, p. 209, figs. 1-3.

Type specimen: Male, Naturh. Mus. Wien, from "Sumatra".

Genus *Aulacobolus* Pocock

Aulacobolus Pocock, 1903, Ann. & Mag. Nat. Hist., ser. 7, vol. 12, p. 530.

Type species: *Spirobolus urocerus* Pocock, 1892.

Aulacobolus Silvestri, 1916, Rec. Indian Mus., vol. 12, p. 41. — Attems, 1936, Mem. Indian Mus., vol. 11, p. 307. — Carl, 1941, Rev. Suisse Zool., vol. 48, p. 612.

Titsonobolus Chamberlin, 1930, Univ. California Publ. Zool., vol. 19, p. 396. Type species: *T. uncopygus* Chamberlin, by original designation.

This is the largest genus of Indian spirobolids, now comprising some ten species and several geographic races. In the reference cited above, Dr. Carl has published a good summary, with remarks on geographic distribution and taxonomic characters.

Almost all of the external features vary considerably: shape of the epiproct, sculpture of the tergites, sternocoxite of the 2nd legs of males, and, of course, the male genitalia. Apparently none of these different characters vary in a particularly concordant way, so we cannot distinguish natural subgeneric groups very readily.

All of the species but one are restricted to the Indian peninsula. This exceptional form occurs in the Indo-china peninsula. There is some reason to suspect it may actually be referable to a different genus (see below, *A. rubropunctatus*).

The relationship of this genus with *Eucentrobolus*, also of south India, needs re-examination. CARL (1941) keeps them separate, but does not mention the basis for distinction. The gonopods of *E. maindroni* appear to be essentially like those of *Aulacobolus*.

Aulacobolus uncopygus (Chamberlin), new combination.

Tisonobolus uncopygus Chamberlin, 1930, California Publ. Zoo., vol. 19, p. 396, figs. 29, 30.

Aulacobolus levissimus Attems, 1936, Mem. Indian Mus., vol. 11, p. 310, fig. 92 a-f. — Carl, 1941, Rev. Suisse Zool., vol. 48, p. 623, figs. 81, 82.

Dr. Carl has pointed out the probable synonymy of the two names cited above, retaining Attems' *levissimus* as the correct one "... weil unter ihm erst das ♂ beschrieben wurde, das mir den Zusammenhang erklärte ". Although Carl's sentiment here is a praiseworthy one, nonetheless under the International Rules of Zoological Nomenclature we must accept Chamberlin's older designation *uncopygus* for this species.

Aulacobolus thurstoni (Pocock)

Figs. 13-17.

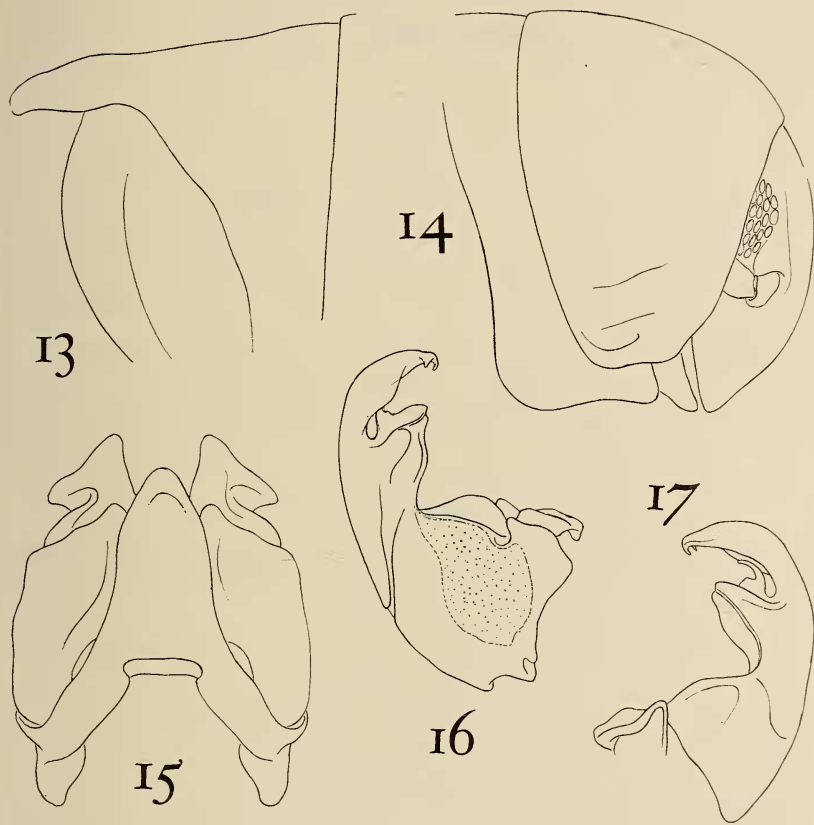
Spirobolus thurstoni Pocock, 1892, Journ. Bombay Nat. Hist. Soc., vol. 7, p. 167.

Aulacobolus thurstoni Silvestri, 1916, Rec. Indian Mus., vol. 12, p. 41. — Attems, 1936, Mem. Ind. Mus., vol. 12, p. 311. — Carl, 1941, Rev. Suisse Zool., vol. 48, p. 614.

Type specimens: Cotypes. Brit. Mus. (Nat. Hist.), from Madras, south India. The specimen upon which Pocock apparently based his description (partly dissected, pinned) has been isolated and labeled as lectotype.

Remarks: Pocock's original account leaves no doubt that *thurstoni* is referable to *Aulacobolus* in its present broad sense, but heretofore the characters of the gonopods have been unknown. The accompanying illustrations were made from the lectotype at

London. Unfortunately, I neglected to dissect and draw the second pair of legs. The phallopods (figs. 16 and 17) belong in the group "2 (c)" of Carl's classification, along with *perfidus*, *newtoni*, and *levissimus*.



Aulacobolus thurstoni (Pocock).

FIG. 13. Posterior end of body, showing epiproct and upper half of paraproct. — FIG. 14. Head, collum, and 2nd segment in lateral aspect. — FIG. 15. Coleopods, anterior aspect. — FIG. 16. Phallopod, mesial aspect. — FIG. 17. Phallopod, lateral aspect. Drawings from the male lectotype.

Aulacobolus rubropunctatus Attems

Aulacobolus rubropunctatus Attems, 1938, Mem. mus. nat. hist. natur., n. s., vol. 6, p. 261, figs. 130-133.

Atopochetus rubrodorsalis Attems, 1953, Mem. mus. nat. hist. natur., ser. A, vol. 5, p. 192, figs. 100-102. NEW SYNONYMY!

Type specimens: Of *rubropunctatus*, male, Mus. Hist. nat. Paris; of *rubrodorsalis*, male, Mus. Hist. nat. Paris. I believe that in both cases, the gonopods were retained by Attems as microscope preparations.

Remarks: There seems to be little doubt that Attems has re-described the same species in different publications. The descriptions of the two forms agree in all details, and the illustrations match very closely. If we allow for errors in the 2nd description owing to Attem's advanced years, the two sets of drawings could readily have been made from the same preparations! Finally, both of the species were taken at the same locality: Ream, Cambodia.

The generic status of *rubropunctatus* remains to be settled finally. There is evidence to suggest it does not belong with *Aulacobolus*: first, the geographic distribution is unlikely; second, according to Attems' figure 101 of the 1953 paper, the coxite of the coleopods does not turn inward on the posterior side and project mesially to separate the telopodite from the sternal extension. In short, the coleopod is constructed much like that of *Tonkinbolus* and *Trachelomegalus*, and differs considerably from that of *Aulacobolus* in which the base of the coleopod telopodite is supported on the caudal side by the inward prolongation of the coxite. On the other hand, the formation of the phallopod appears to be more like that of *Aulacobolus*, in having a short inner process which carries the end of the seminal groove. The original basis for the genus *Atopochetus* (as well as the family name *Atopochetidae*) was the alledged presence of a chamber in this inner process, from which another groove emerged, proceeding on to the end of the phallopod. This is such a novel and unprecedented structure in spirobolids that I feel sure it represents a misinterpretation of the actual structure. In pachybolids the phallopod is often complicated by the presence of folds, striations, creases, and quantities of whitish connective tissue.

It does seem possible, even likely, that *Atopochetus* can be retained as a valid genus related to *Tonkinbolus*. I hesitate to take such a step without having first examined specimens for a personal study of gonopod structure.

There is no defensible reason for recognition of the family *Atopochetidae*, and it is to be observed that one of the included genera is a fairly typical pachybolid of the *Trachelomegalus*-group, the other is a very typical Australian trioniulid which has already

been described: *Prionopeza* Attems = *Zygostrophus* Chamberlin, NEW SYNONYMY, also *Prionopeza serrulata* Attems = *Zygostrophus digitulus* (Brolemann), NEW SYNONYMY!

Finally, I have already remarked (supra, p. 775), the likelihood that the name *rubropunctatus* may be a junior synonym of Pocock's *Spirobolus dollfusi*, which was described from the same general area.

Genus *Stenobolus* Carl

Stenobolus Carl, 1918, Rev. Suisse Zool., vol. 26, p. 453. Type species: *S. insularis* Carl, by monotypy.

Dekanbolus Verhoeff, 1938, Arch. Naturg., N.F., vol. 7, p. 629. Type species: *D. rubellus* Verhoeff, by monotypy. NEW SYNONYMY!

Carl's good description of this genus correctly judged it to be related to *Mystalides* and *Metiche*. The type species is particularly rather similar to *Mystalides bivirgatus* (Karsch) in gonopod characters.

Stenobolus insularis Carl

Stenobolus insularis Carl, 1919, Rev. Suisse Zool., vol. 26, p. 452, figs. 33-36.

Dekanbolus rubellus Verhoeff, 1938, Arch. Naturg., N.F., vol. 7, p. 629. NEW SYNONYMY!

Type specimens: Of *insularis*, Mus. Hist. nat. Genève; of *rubellus*, Zool. Staatssamm. München. I have examined both specimens.

Remarks: Verhoeff's name *rubellus* is based upon a specimen of *insularis* from India. It must have been colored differently from Carl's material, as suggested by the specific name, but the gonopods of the two are identical in every respect. Carl's types were from Male Atoll in the Maldives, to which the species may have been introduced from the mainland of peninsular India.

Genus *Xenobolus* Carl

Diaphoropus Silvestri, 1897, Ann. mus. civ. stor. nat. Genova, vol. 38, p. 651. Type species: *Iulus carnifex* Fabricius, 1775, by original designation. (Preoccupied by *Diaphoropus* Bate, 1888.)

Xenobolus Carl, 1919, Rev. Suisse Zool., vol. 27, p. 393. Type species: *Iulus carnifex* Fabricius, 1775, by original designation.
Erythroprosopon Verhoeff, 1936, Rec. Indian Mus., vol. 11, p. 306. Type species: *Erythroprosopon phoenix* Verhoeff, 1936, by monotypy.
 NEW SYNONYMY!

Carl was evidently unaware of Silvestri's earlier name, which, had it not been preoccupied, would of course be the correct one for this genus. *Xenobolus* has usually been placed in the family *Trigoniulidae*, but Verhoeff considered his genus *Erythroprosopon* to be referable to the "*Spiromimidae*". I think that in general *Xenobolus* agrees closely with the African forms of *Pachybolidae*, and appears to be closely related to *Stenobolus* and *Mystalides*. So far two species of *Xenobolus* are known, listed below.

The brilliant colors of these species are unusual for *Pachybolidae*!

Xenobolus carnifex (Fabricius)

Iulus carnifex Fabricius, 1775, Syst. Entom., p. 428.
Spirobolus carnifex Brandt, 1841, Rec. mem., p. 188. — Gervais, 1847, Hist. nat. Insectes Apt., vol. 4, p. 163. — Koch, 1863, Die Myriapoden, vol. 1, p. 62, pl. 27, fig. 53. — Pocock, 1892, Journ. Bombay Nat. Hist. Soc., vol. 8, p. 36, fig. 9.
Spirobolus ruficollis Newport, 1844, Ann. & Mag. Nat. Hist., vol. 13, p. 269.
Diaphoropus carnifex Silvestri, 1897, Ann. mus. civ. stor. nat. Genova, vol. 38, p. 651.
Xenobolus carnifex Carl, 1919, Rev. Suisse Zool., vol. 27, p. 394, figs. 23-31. — Attems, 1936, Mem. Indian Mus., vol. 11, p. 304.
Erythroprosopon phoenix Verhoeff, 1936, Rec. Indian Mus., vol. 38, p. 503. NEW SYNONYMY!

Type specimens: of *carnifex*, unknown, if extant; of *ruficollis*, Brit. Mus. (Nat. Hist.); of *phoenix*, Zool. Staatssamm. München.

Remarks: This is an abundant and well-known species occurring in south India and Ceylon. Verhoeff was guilty of the most consummate carelessness in redescribing it as a new genus and species.

Xenobolus acuticonus Attems

Xenobolus acuticonus Attems, 1936, Mem. Indian Mus., vol. 11, p. 303, figs. 87 a-d.

Type specimens: Naturh. Mus. Wien, from Madras, India.

Remarks: The gonopods of this species are virtually identical with those of *carnifex*. Attems did not give any differentiating characters for *acuticonus*, and the only differences I can find in his description are in the coloration. Both species are blackish dorsally, *carnifex* has the head, collum, anal segment, and a broad median band bright red; whereas *acuticonus* is said to have the head, collum, and anal segment reddish-brown, with a row of middorsal, hourglass-shaped reddish spots instead of the dorsal band. This character does not seem to be a very strong one, since many juliform species are known to be quite variable in color pattern. But future studies in south India, particularly at Madras, can settle the point.

Genus *Lankabolus* Carl

Lankabolus Carl, 1941, Rev. Suisse Zool., vol. 48, p. 604. Type species: *L. coelebs* Carl, by monotypy.

This trigoniulid genus appears to be endemic to Ceylon. Carl distinguished it from *Trigoniulus* chiefly by the absence of scale-like hairs from the inner process of the phallopod.

Lankabolus greeni (Pocock), new combination.

Figs. 18-20.

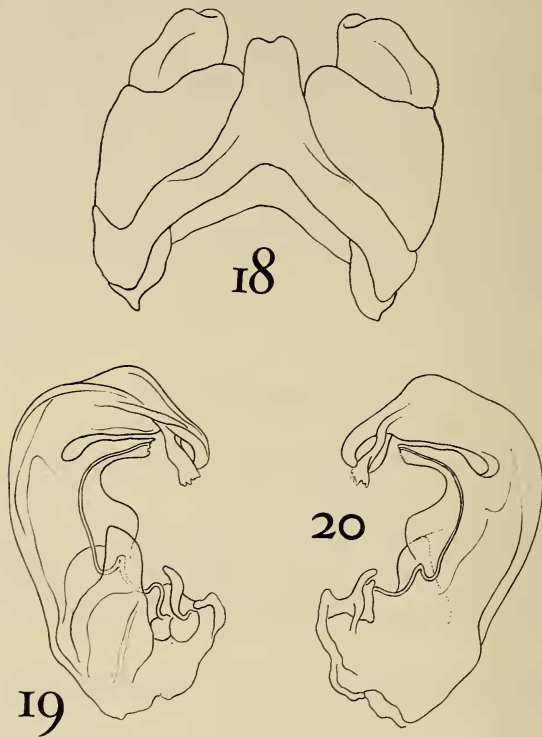
Spirobolus greeni Pocock, 1892, Journ. Bombay Nat. Hist. Soc., vol. 7, p. 170. — Attems, 1936, Mem. Indian Mus., vol. 11, p. 312 — Carl, 1941, Rev. Suisse Zool., vol. 48, p. 607.

Lankabolus coelebs Carl, 1941, Rev. Suisse Zool., vol. 48, p. 605, figs. 57, 58. NEW SYNONYMY!

Type specimens: Of *greeni*, Brit. Mus. (Nat. Hist.) 90.10.22.47; of *coelebs*, Mus. Hist. nat. Genève. *S. greeni* was based on several cotypes; I have designated one of these as lectotype. It is impaled upon a long pin, and is obviously the specimen upon which Pocock based his description.

Remarks: CARL (1941) was aware of the existence of Pocock's earlier name, based upon material taken at the same locality and by the same collector as his series of *coelebs* cotypes. He even remarked the similarity of Pocock's species to his own, and it is

therefore curious that he does not consider the two series conspecific. I have seen the types of both and find them identical.



Lankabulus greeni (Pocock).

FIG. 18. Coleopods, anterior aspect. — FIG. 19. Phallopod, mesial aspect. — FIG. 20. Phallopod, lateral aspect.

Carl's drawing of the *coleopods* is not in correct proportion, the median projection of the sternite being shown much too long and slender. Compare instead the accompanying figure 18.

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